

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

**Listing of claims:**

1-122 (Cancelled)

123. (New) A method for entangling a quantum state of a first qubit with a quantum state of a resonant control system, the method comprising:

tuning a resonant control system, which is capacitively or inductively coupled to said first qubit, to a resonant frequency for a period of time, wherein said resonant frequency corresponds to an energy difference between a first energy level and a second energy level of said first qubit, thereby entangling the quantum state of said first qubit with the quantum state of said resonant control system.

124. (New) The method of claim 123, wherein said resonant control system is an anharmonic resonator.

125. (New) The method of claim 123, wherein said resonant control system is superconducting.

126. (New) The method of claim 123, wherein said resonant control system comprises a Josephson junction and a bias current source that is connected in series with said Josephson junction, and wherein said tuning comprises altering the magnitude of said bias current source.

127. (New) The method of claim 126, wherein the magnitude of said bias current source is  $0.994 \cdot I_c$  or less during said tuning, wherein  $I_c$  is the critical current of said Josephson junction.

128. (New) The method of claim 126, wherein the magnitude of said bias current source is  $0.990 \cdot I_c$  or less during said tuning, wherein  $I_c$  is the critical current of said Josephson junction.

129. (New) The method of claim 123, wherein said period of time is one microsecond or less.

130. (New) The method of claim 123, wherein said period of time is one hundred nanoseconds or less.

131. (New) The method of claim 123, wherein said period of time is long enough for said quantum state of said resonant control system to entangle with said quantum state of said first qubit.

132. (New) The method of claim 123, the method further comprising:  
applying a first quantum gate to said first qubit prior to said tuning; and  
applying a second quantum gate to said first qubit after said tuning.

133. (New) The method of claim 132, wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

134. (New) The method of claim 123, wherein said coupling of said first qubit to said resonant control system is described by a native interaction Hamiltonian that includes an off diagonal interaction term.

135. (New) The method of claim 123, wherein said first qubit is a superconducting charge qubit or a superconducting phase qubit.

136. (New) The method of claim 123, wherein the resonant control system is capacitively or inductively coupled to a plurality of qubits, wherein the plurality of qubits includes said first qubit.

137. (New) The method of claim 123, wherein the first qubit is a superconducting qubit.

138. (New) The method of claim 123, wherein the first qubit is described by a native interaction Hamiltonian that includes a diagonal interaction term.